MODEL 920
STANDARD DEVIATION METER

Operating INSTRUCTIONS

MEASUREMENTS

BOONTON NEW JERSEY

EDISON ELECTRONICS DIVISION McGraw-Edison Company
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MODEL 920
STANDARD DEVIATION METER

Operating INSTRUCTIONS

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MEASUREMENTS
A McGRAW-EDISON DIVISION
BOONTON **NEW JERSEY**

TABLE OF CONTENTS

		Page
Foreword		1
Front View of Model 920		2
Block Diagram		3
Section I	INTRODUCTION	4
	A. Scope of Manual	4
Section II	DESCRIPTION AND DATA	4
	A. General	4
	B. Technical Characteristics	5
	C. Design Features	6
	D. Components Supplied	7
	E. Packaging	8
Section III	CONTROL FUNCTIONS	8
	A. Power	8
	B. Input Gain Control	8
	C. Local Oscillator Tuning	8
	D. Fine Tuning	9
	E. Meter Range Switch	9
	F. Audio Spkr.	10
	G. Audio Level	10
	H. Scope	10
	I. + Deviation -	10
Section IV	POWER SUPPLY	10
	A. Battery Operation	10
	B. A.C. Operation	11
	C. Battery Recharging Procedure	11

		Page
Section V	OPERATION	12
	A. Deviation Measurements	12
	B. Distortion Measurements	14
	C. Noise Measurements	14
Section VI	MAINTENANCE	15
	A. General Precautions	15
	B. Battery Installation	15
	C. Removing The Instrument From The Case	16
	D. Distortion Adjust	16
	E. Filter Termination Adjust	16
	F. Divider Adjust	17
	G. Meter Adjust	17
	H. Discriminator Adjust	18
	I. Power Overloads (Mixer CR4) Replacement	18
Section VII	STORAGE AND SHIPMENT	19
	A. Storage	19
	B. Shipment	19
Section VIII	TABLE OF REPLACEABLE PARTS	20
Section IX	PRINTED CIRCUIT BOARD PARTS LAYOUT	
	A. Local Oscillator Board	34
	B. I.F. Board	35
	C. Pulse Network Board	36
	D. Audio Board	37
	E. Filter and Power Supply Board	38
APPENDIX I	SCHEMATIC DIAGRAM	

FOREWORD

Additional information with regard to the applications and maintenance of this equipment will be available from time to time. Users of the Model 920 Standard Deviation Meter are urged to discuss their problems with us and to suggest such modifications as might make the instrument more adaptable to their special requirements.

Whenever possible, maintenance difficulties should be reported to MEASUREMENTS before proceeding with the actual repairs. Through our familiarity with the instrument, we are in a position to suggest the most expedient and accurate repair procedure.

Your Model 920 Standard Deviation Meter has been designed and manufactured to the highest standards of instrument quality. With reasonable care, many years of trouble-free service can be expected of it.

Engineering Department

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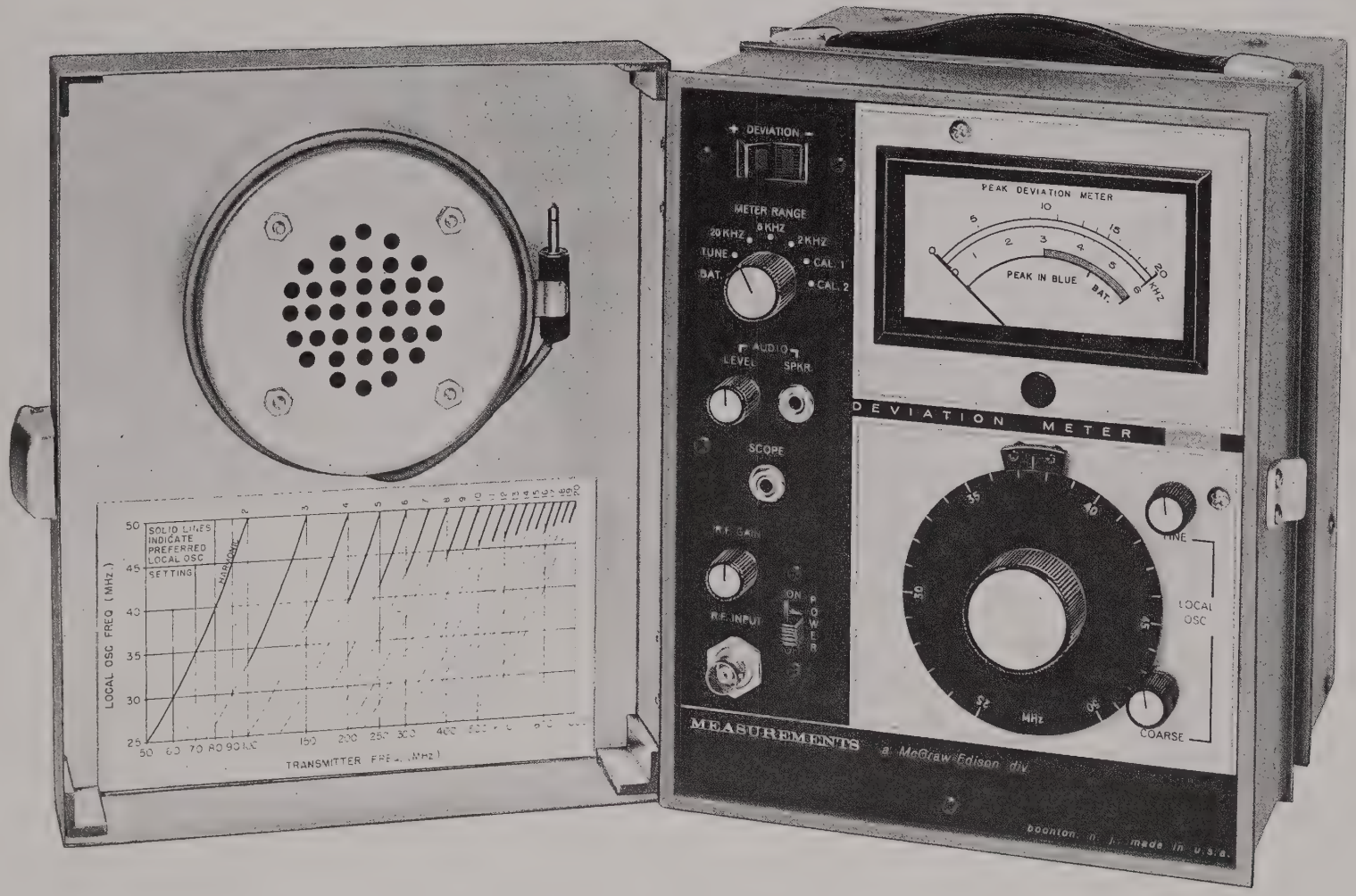
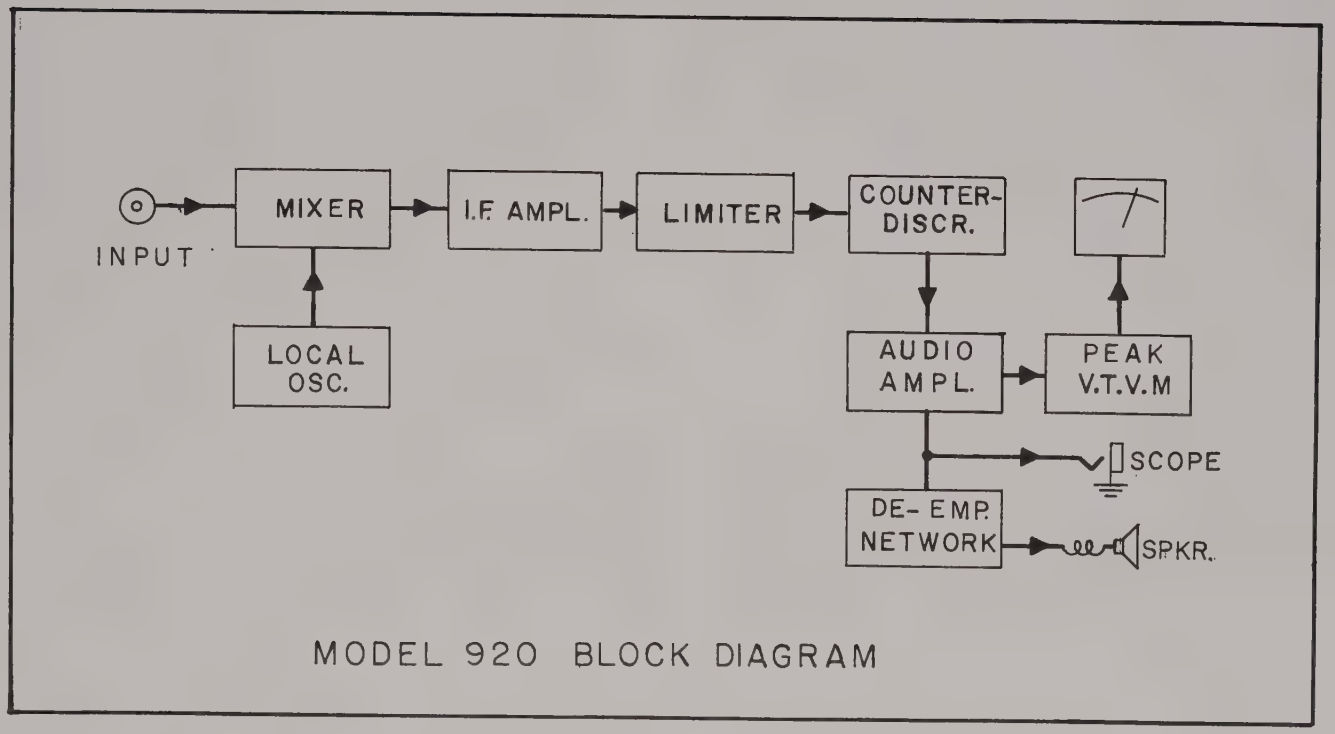


Figue 1. Front View of the Model 920 Standard Deviation Meter



MODEL 920 BLOCK DIAGRAM

SECTION I

INTRODUCTION

A. SCOPE OF MANUAL

a. This manual describes the operation of the Model 920 Standard Deviation Meter for measuring peak deviation of F.M. transmitters. To insure optimum performance, instructions for field maintenance are included, along with a list of replaceable parts.

SECTION II

DESCRIPTION AND DATA

A. GENERAL

a. The Model 920 Deviation Meter is designed to accurately measure the peak frequency deviation of frequency modulated communication transmitters.

The Model 920 contains an accurate, linear, counter-type discriminator and a reliable peak reading voltmeter.

The highly stable conversion oscillator allows measurement at frequencies from 25 to 1000 MHz with low inherent residual frequency modulation and maximum freedom from drift. To extend the useful range of the instrument below 25 MHz, an external oscillator may be used to hetrodyne transmitter frequencies to the 100 kHz intermediate frequency.

A discriminator output is available from the two front panel jacks labeled SCOPE and SPKR. The output from the SPKR. jack includes a 750 micro-second de-emphasis network which allows the Model 920 Deviation Meter to be used as a standard

receiver meeting the requirements of EIA Standard RS-152-A. Considerable care was taken in the manufacture of the Model 920 to insure low inherent noise and distortion compatable with the EIA Standard. The SPKR. jack provides a convenient source for measurements of distortion and noise, or it may be used to drive the 8 ohm speaker provided in the front panel cover.

The SCOPE output jack provides a linear output from the discriminator, and therefore noise and distortion measurements may be made without the de-emphasis network.

The output of both the SPKR. jack and the SCOPE jack may be viewed on an oscilliscope.

B. TECHNICAL CHARACTERISTICS

a. Carrier Frequency Range: 25 - 1000 MHz (25 - 50 MHz local oscillator provides useful harmonics to 1000 MHz.)

b. Sensitivity: 25 millivolts at frequencies to 500 MHz; 50 millivolts to frequencies of 1000 MHz.

c. Residual Frequency Modulation: Less than 100 Hz at 500 MHz.

d. Input Impedance: Nominally 50 ohms.

e. Deviation Ranges: 0 to 2 kHz, 0 to 6 kHz, 0 to 20 kHz.

f. Deviation Accuracy: $\pm$3% of full scale.

g. Modulation Frequency Response: Flat from 100 Hz to 8 kHz.

h. Input Gain Control: Linear taper poteriometer provides 26 db of attenuation.

i. Maximum Power Input: 200 milliwatts.

j. Speaker Output: Provides a 750 micro-second de-emphasis network. This jack may be used to drive the 8 ohm speaker provided in the front cover. The level of de-emphasized audio output may be adjusted with the AUDIO LEVEL control.

k. SCOPE Output: Provides a linear audio output from an emitter follower.

l. Power Supply: A well regulated power supply operates off a 115 volt 50-60 Hz line. Provision is also made for battery operation. Three Eveready rechargeable batteries #563 or their equivelent may be used. Nine "D" size cells may also be used. Maximum power consumption is 3 watts

C. DESIGN FREATURES

a. The Model 920 Standard Deviation Meter is a completely self contained solid state unit which is portable, accurate, and simple to operate.

b. Measurements are easily read on a large, linear, taught-band panel meter.

c. An extremely stable local oscillator provides useful harmonics up to 1000 MHz. This oscillator is completely shielded to minimize residual noise.

d. For maximum portability the Model 920 may be powered from batteries, (nominally 13.5 volts) or from a 115 volt 50-60 Hz power line.

e. When the Model 920 Standard Deviation Meter is operated from the AC power line, a well regulated and well filtered D.C. power supply provides good stability and low residual hum and noise.

f. A charging circuit is provided to recharge rechargeable batteries up to their nominal voltage.

g. Three deviation ranges from 0 to 2 kHz, 0 to 6 kHz, and 0 to 20 kHz are provided.

h. SPKR. Output is provided along with an 8 ohm speaker mounted in the front cover. The speaker output includes a 750 micro-second de-emphasis network, and a level control.

i. SCOPE Output is available from a front panel jack. This output is linear and may be viewed on an oscilliscope.

j. A deviation (+) (-) switch allows the measurement of peak deviation on both sides of the carrier.

D. COMPONENTS SUPPLIED

a. The following is included with each shipment:

1 Model 920 Standard Deviation Meter

Approx.	Weight (less batteries)	10 lbs.
	Height	9"
	Width	7"
	Depth	8½"
	Volume	.3 cu. ft.

1 Cover with speaker

1 Power Cord

1 Manual of Operating and Maintenance Instructions

1 Antenna

E. PACKAGING

	Domestic	Export
Approx. Weight (less batteries)	13 lbs.	25 lbs.
Length	13"	21"
Width	10"	13"
Depth	12"	16"
Volume	.9 cu. ft.	2.5 cu. ft.

For export the Model 920 is packed in a wooden shipping container.

SECTION III

CONTROL FUNCTIONS

A. POWER

a. The three position POWER SELECT switch located on the back of the 920 selects either AC Line Operation, Battery Operation or Battery Charge position.

b. The ON-OFF switch on the front panel controls the application of bias voltage to the circuits of the Model 920.

c. The fuses located in the back of the instrument protect against overload.

B. INPUT GAIN CONTROL

a. This is a linear poteniometer which adjusts the gain of the signal applied to the metering circuits. Approximately 26 db attenuation is possible.

C. LOCAL OSCILLATOR TUNING

a. This dial controls the tuning of the local oscillator which operates between 25-50 MHz. The local oscillator has useful harmonics to 1000 MHz and is mixed with the incoming

signal to produce the 100 kHz intermediate frequency.

D. FINE TUNING

a. This control permits extremely fine electronic adjustment of the local oscillator frequency to facilitate tuning.

E. METER RANGE SWITCH

a. This switch selects the meter function as described in the following:

1. BAT: In this position the meter checks the D.C.. supply voltage necessary for accurate operation. If the POWER SELECT switch SW3 is in the A.C. position the meter indicates the rectified and filtered A.C. voltage. This reading should be somewhere in the portion of the meter marked BAT.

If the POWER SELECT switch is in the BAT. position the meter indicates the battery voltage. The battery volatge should indicate three quarter scale or greater. A line indicating minimum battery voltage is marked on the meter scale. If the battery voltage is low the batteries should be recharged as per instructions Section IV Paragraph C.

NOTE

DO NOT ATTEMPT TO RECHARGE NON-RECHARGEABLE BATTERIES.

2. TUNE: In this position the meter will peak when the local oscillator is adjusted to produce a 100 kHz beat with the incoming signal.

3. 20 kHz, 6 kHz, or 2 kHz; these positions select the desired meter deviation range.

4. CAL 1: This position is used only when checking the discriminator.

5. CAL 2: This position is used to check the gain of the audio amplifier.

F. AUDIO SPKR: This front panel jack provides a low impedance output for speaker connections. This output circuit contains a 750 micro-second de-emphasis network.

G. AUDIO LEVEL: Controls the output level from the SPKR. jack.

H. SCOPE: A front panel jack which provides a linear audio output.

I. + DEVIATION - : This switch allows the measurement of deviation on both sides of the carrier.

SECTION IV

POWER SUPPLY

A. BATTERY OPERATION

a. The Model 920 may be used with three #563, 4.5 volt rechargeable Eveready batteries or their equivelent, or with nine standard "D" cells.

The following procedure should be followed to battery operate the Model 920:

1. Disconnect the A.C. power cord.

2. Slide the power select switch on the back of the instrument to the BAT. position.

3. Rotate the METER RANGE switch SW1 on the front panel to BAT. If the meter reads above the three quarter

scale as indicated by the BAT. marking on the meter, then there is sufficient battery voltage for accurate operation.

4. If the meter reads below the BAT. mark then the batteries should be replaced or recharged to insure accurate operation.

B. A.C. OPERATION

a. The Model 920 may be operated from a 115 volt 50-60 Hz source of line voltage as follows:

1. Connect the line cord provided with the Model 920 between the connector on the back of the case and the A.C. plug.

2. Slide the POWER SELECT switch SW3 located on the back of the case to the A.C. position. The instrument is now ready for operation.

C. BATTERY RECHARGING PROCEDURE

CAUTION

DO NOT ATTEMPT TO RECHARGE NON-RECHARGEABLE BATTERIES.

a. The Model 920 has a built in charging circuit for maximum convenience in recharging run down batteries.

If the BAT. check position indicates that the battery voltage is low connect the Model 920 to the A.C. power line and switch the POWER SELECT switch SW3 on the back of the instrument to the CHARGE position. The batteries are now being charged. It is not necessary to have the front panel POWER switch in the ON position to charge batteries.

A full scale meter reading in the BAT. check position indicates that the batteries are charged to their nominal voltage of 13.5 volts. This is the ideal maximum voltage to which the batteries should be charged.

An overnight charge is recommended. However a longer charge will not harm the instrument although the useful battery life may be shortened. The actual number of hours necessary to recharge the batteries is dependent on the battery voltage at the start of the charge and the number of times that the batteries have been recharged previously.

SECTION V

OPERATION

A. DEVIATION MEASUREMENETS

The following procedures are identical for either battery or A.C. operation.

NOTE

WHEN FIRST MAKING DEVIATION READINGS WHERE SIGNAL STRENGTH IS UNKNOWN, IT IS BEST TO LOOSELY COUPLE TO THE TRANSMITTER UNDER TEST OR TO USE AN EXTERNAL ATTENUATOR. THIS PROCEDURE PROTECTS THE MIXER DIODE CR4 FROM OVERLOADS.

a. Place the METER RANGE switch in the TUNE position and rotate the LOCAL OSCILLATOR TUNING to obtain a peak meter reading. This will be obtained whenever the local oscillator (fundamental or harmonic frequency) is exactly 100 kHz away from the input frequency. When the transmitter frequency is

between 25 and 50 MHz, the fundamental frequency of the local oscillator is used. When the transmitter is above 50 MHz, harmonics of the local oscillator will produce the desired 100 kHz difference frequency. The following chart lists dial readings that may be used at various mobile transmitter frequencies.

Mobile Transmitter Frequency (MHz)	Model 920 (±100 kHz)	Harmonic
25 to 50	25 to 50	Fundamental
50 " 54	25 " 27	2nd
129 " 141	43 " 47	3rd
141 " 150	47 " 50	3rd
150 " 160	37.5" 40	4th
160 " 174	40 " 43.5	4th
396 " 432	44 " 48	9th
432 " 450	48 " 50	9th
450 " 470	45 " 48	10th
874 " 912	46 " 48	19th
912 " 950	48 " 50	19th
950 " 960	47.5" 48	20th

b. Adjust INPUT GAIN to bring meter pointer within blue area of the scale. If necessary, reduce coupling to the transmitter under test, or use an external attenuator to allow peaking in the blue area.

NOTE

WHEN USING HARMONICS OF THE LOCAL OSCILLATOR, ALWAYS USE THE HIGHEST FREQUENCY SETTING OF THE DIAL (LOWEST HARMONIC) FOR MAXIMUM SENSITIVITY.

c. Place METER RANGE switch in either 20 kHz, 6 kHz, or 2 kHz position and read deviation directly on meter scale. If the local oscillator frequency is below the signal frequency,

the meter will indicate deviation on the high side of carrier, when the (+) (-) switch is in (+) position. (Peak deviation is equal to one half the sum of the (+) and (-) deviation readings.) Unequal positive and negative readings indicate modulation asymmetry.

B. DISTORTION MEASUREMENTS

a. Tune the Model 920 to the transmitter signal as described in SECTION V, Paragraph A, then connect a suitable distortion meter to the SCOPE jack.

Inherent distortion in the Model 920 is normally less than one per cent of the 10 kHz deviation level.

C. NOISE MEASUREMENTS

a. Residual carrier noise may be measured by connecting a high impedance audio frequency voltmeter to the SCOPE jack. The inherent noise of the Model 920 is approximately -45 db at 150 MHz, standarized at 10 kHz deviation, and at 1 kHz modulating frequency.

NOTE

BOTH DISTORTION AND NOISE MEASUREMENT MAY BE MADE AT THE SPKR. JACK IF IT IS DESIRED TO MAKE THE MEASUREMENTS THROUGH A 750 MICRO-SECOND DE-EMPHASIS NETWORK. IN THIS CASE THE AUDIO LEVEL CONTROL SHOULD NOT BE TURNED UP SO HIGH THAT CLIPPING TAKES PLACE.

SECTION VI

MAINTENANCE

A. GENERAL PRECAUTIONS

a. The purpose of this section is to aquaint operating and maintenance personal with procedures for making certain adjustments that may be necessary after critical parts are replaced.

b. It should be noted that most of the field replaceable parts are available from MEASUREMENTS. Please refer to MEASUREMENT's part numbers when ordering. The adjustment procedures outlined in this section should be carefully followed. When the described test equipment is not available, it would be adviseable to return the Model 920 to MEASUREMENTS for repair.

B. BATTERY INSTALLATION

a. Remove the four screws from the sides of the back portion of the case. These screws are located, one on each side, approximately 2½" in from the back of the instrument.

b. Remove the back portion of the instrument and disconnect the power connector.

c. Remove the battery hold down strap mounted with four screws to the bottom and side of the back of the case.

d. Install batteries being sure to observe polarity as indicated by the markings on the battery holder.

e. Reassemble the back cover of the instrument.

C. REMOVING THE INSTRUMENT FROM THE CASE

a. Disconnect the power cord from the rear of the case and lift the front cover from the hinges.

b. Lay the instrument on its back and remove the four screws located on the center lines and nearest the outside edge of the front panel.

c. Lift the instrument out of its case being careful not to hit the function switch or any of the printed circuit boards.

D. DISTORTION ADJUST.

a. Remove the instrument from its case.

b. Connect an audio oscillator set at approximately 1 kHz to the single terminal cinch strip located on the back chassis of the Model 920.

c. Switch the METER RANGE switch to the CAL 2 position.

d. Adjust the audio oscillator output for a full scale reading on the Model 920.

e. Connect SCOPE output of the Model 920 to the input of a distortion analyzer and adjust R100 for minimum distortion.

E. FILTER TERMINATION ADJUST

a. Connect an audio oscillator to the single terminal cinch strip located on the back chassis.

b. Monitor the output of the audio oscillator with an oscilliscope or VTVM.

c. Set the audio oscillator at 400 Hz and adjust the output voltage for a full scale reading on M1.

d. Keeping the audio oscillator output constant set the audio frequency to 6 kHz and adjust R-136 for a full scale reading on M1.

e. Repeat procedures c and d until the same reading can be obtained on M1 at both frequencies.

F. DIVIDER ADJUST

a. Connect an audio oscillator set at approximately 1000 Hz to the wiper of deck E on SW1. (Deck E is located furthest from the front panel)

b. Switch the METER RANGE switch to the 20 kHz position.

c. Connect an oscilliscope or VTVM to the junction of R80 and R82 located on deck E of SW1.

d. Adjust the Divider Adjust. R-90 until the voltage at the junction of R80 and R82 is one tenth the voltage as measured at the output of the audio oscillator.

G. METER ADJUST

a. Switch the METER RANGE switch to the CAL 2 position.

b. Connect an audio oscillator set at approximately 1000 Hz to the singal terminal cinch strip located on the back of the mounting chassis.

c. Set the output of the audio generator to 4 volts "peak-to- peak".

d. Adjust meter adjust poteniometer R96 for full scale deflection as viewed on meter M1.

H. DISCRIMINATOR ADJUST

a. Connect a 100 kHz $\pm$1% oscillator to the input connector of the Model 920.

b. Place METER RANGE switch in the TUNE position, and adjust the signal strength to bring the meter pointer to the blue area of the scale.

c. Place METER RANGE switch in CAL 1 position. The meter should indicate full scale deflection. If necessary adjust R73 to bring the meter reading to full scale.

NOTE

THE ABOVE ADJUSTMENTS "E" THROUGH "H" MAY EFFECT EACH OTHER AND SHOULD BE DOUBLE CHECKED FOR ANY SLIGHT READJUSTMENTS THAT ARE NECESSARY.

I. POWER OVERLOADS (MIXER DIODE CR4) REPLACEMENT

If the input to the Model 920 exceeds approximately 200 millwatts, there is danger that mixer diode CR4 may be damaged.

Mixer diode CR4 may be replaced as follows:

1. Remove the instrument from its case.

2. Remove the pulse network printed circuit board mounted on the right side of the Model 920 from its connector.

3. Remove the four screws holding the shield plate of the local oscillator board which is mounted underneath the pulse network board.

4. Refer to the printed circuit board layout of the local oscillator board and remove mixer diode CR4 from the diode "snap clips".

5. "Snap in" the replacement diode being sure to observe

the correct polarity.

6. Reassemble the Model 920.

SECTION VII

STORAGE AND SHIPMENT

A. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere. When the use of bag and desiccant is necessary, the instrument should be checked at six-month intervals to determine the effectiveness of the seal.

B. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least three inches of excelsior or similar packing material between the instrument and sides of the box. For export packing the instrument must be wrapped in water-proof paper and the seams sealed with water-proof glue or similar sealing compound before being placed in a wooden box.

SECTION VIII

TABLE OF REPLACEABLE PARTS

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description
Capacitors		
C1	H-5515	Ceramic Feed-thru 1 K mmf GMV
2	H-5515	" " " " " "
3	H-6663-3	" Tubular 5 mmf ±10%
4	H-6663-5	" " 15 " "
5	H-6619-9	" Disc .001 mf "
6	H-8445	Variable; Air Dielectric 2 sections
7	H-8454-9	Mica 220 mmf ±10% 100V
8	H-6663-3	Ceramic Tubular 5 mmf ±10%
9	H-5580	" Feedthru 55 mmf
10	H-6619-9	" Disc .001 mf ±10%
C20	H-7886-8	Mylar .01 mf ±20%
21	H-7887-6	Electrolytic 10 mf 25V
22	H-7886-7	Mylar .1 mf ±20%
23	H-7886-8	" .01 mf ±20%
24	H-7886-8	" " " "
26	H-7887-6	Electrolytic 10 mf 25V

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description		
C27	H-7886-7	Mylar	.1 mf ±20%	
28	H-7886-8	"	.01 mf ±20%	
29	H-7886-8	"	" " "	
30	H-7887-6	Electrolytic	10 mf	25V
31	H-7886-7	Mylar	.1 mf ±20%	
32	H-7886-8	"	.01 mf ±20%	
33	H-7886-7	"	.1 mf ±20%	
34	H-7887-6	Electrolytic	10 mf	25V
35	H-7886-7	Mylar	.1 mf ±20%	
36	H-7886-7	"	" " "	
37	H-7886-7	"	" " "	
38	H-7887-6	Electrolytic	10 mf	25V
39	H-7886-7	Mylar	.1 mf ±20%	
41	H-8454-7	Mica	68 mmf ±10%	100 V
60	H-8454-9	Mica	220 mmf ±10%	100 V
61	H-8454-9	"	" " "	"
62	H-7513-3	Electrolytic	50 mf	15 V
63	H-8454-10	Mica	47 mmf	
64	H-7886-1	Mylar	.22 mf ±20%	
65	H-6663-4	Ceramic Tubular	10 mmf ±10%	
66	H-7513-3	Electrolytic	50 mf	15 V

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description			
C67	H-7886-1	Mylar	.22 mf	±20%	
68	H-8454-8	Mica	150 mmf	±10%	100 V
69	H-7513-3	Electrolytic	50 mf		15 V
80	H-7887-6	Electrolytic	10 mf		25 V
81	H-6671-9	Ceramic	68 mmf	±10%	NPO
90	H-7887-10	Electrolytic	250 mf		12 V
91	H-7887-8	"	50 mf		12 V
92	H-6619-5	Ceramic Disc	2.2K mmf		GMV
93	H-7887-8	Electrolytic	50 mf		12 V
94	H-6618-5	Ceramic Disc	2.2K mmf		GMV
95	H-7887-9	Electrolytic	100 mf		12 V
96	H-7887-7	"	50 mf		12 V
97	H-6619-5	Ceramic Disc	2.2K mmf		GMV
98	H-7887-7	Electrolytic	25 mf		25 V
99	H-7886-7	Mylar	.1 mf	±20%	
C100	H-7886-7	"	" "	"	
101	H-6663-5	Ceramic Disc	15 mmf	±10%	
102	H-7513-19	Electyolytic	2 mf		50 V
103	H-8123-5	Ceramic Disc	470 mmf	±10%	
104	H-7887-9	Electrolytic	25 mf		25 V
105	H-7886-7	Mylar	.1 mf	±20%	
106	H-7887-7	Electrolytic	25 mf		25 V

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description			
C120	H-7513-20	Electrolytic	1000 mf		25 V
121	H-7513-20	"	" "		"
130	H-6619-9	Ceramic Disc	.001 mf	±10%	
131	H-6619-9	" "	" "	"	
132	H-7886-8	Mylar	.01 mf	±20%	
133	H-7513-19	Electrolytic	2 mf		50 V
134	H-7886-8	Mylar	.01 mf	±20%	
135	H-7886-8	"	" "	"	
136	H-7886-8	"	" "	"	
137	H-7886-8	"	" "	"	
138	H-7886-8	"	" "	"	
139	H-7886-7	"	.1 "	"	
140	H-8454-11	Mica	270 mmf	±10%	100 V
141	H-7886-8	Mylar	.01 mf	±20%	
142	H-7886-8	"	.01 mf	±20%	

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description
CR1		Diode V12E
2		" 1N5235A
3		" 1N273
4		" 1N82
5	H-8117	Rectifier 2F4
6	H-8117	" "
CR20		Diode 1N273
21		" "
CR60		Diode 1N273
61		" 1N914
62		" 1N270
CR80		Diode 1N270
CR130		Diode 1N5237B
131		" 1N270
132		" "

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description
Fuses		
F1	H-8498-16	MDV 1/8 amp. slo blow
F120	H-8498-17	AGC 1/2 amp.
Connectors		
J1		Connector UG-909/U
3	H-8500	Socket
4	H-7761	Jack Scope
5	H-7761	" Speaker
Coils		
L1	H-6688-2	R.F. Oscillator coil
2	H-5744	R.F. Choke
20	H-5744	" "
130	H-7170	Filter Coil
131	H-8509	Variable Inductor
Meter		
M1	H-8496	Meter & Bezel

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description
Recepticles		
P1	H-8085	Plug
3	H-8501	"
5	H-8504	"
6		Part of W1
7		" " "
Transistors		
Q1		2N2369
20		2N4123
21		"
22		"
23		"
24		"
25		"
26		"
27		"
60		2N4123
61		"
63		"
64		"
90		2N4123

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description
Transistors		
Q91		2N4123
92		"
93		"
130		2N5294
131		"
132		2N3905
133		2N4123
Switches		
SW1	H-8426	Meter Range
2	H-7749	Deviation
3	H-8506	Power Select
4	H-8075	Power
Transformer		
T1	H-8447	Transformer
Cable		
W1	H-7746	Cord; Power, includes P6 & P7

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description		
Resistors				
R1	H-8431-154	Fixed Comp.	150 K	±10% 1/4W
2	H-8431-473	" "	47 K	" "
3	H-8431-183	" "	18 K	" "
4	H-8497-103	Variable	10 K	±20% 1/2W
5	H-8431-472	Fixed Comp.	4.7 K	±10% 1/4W
6	H-8431-101	" "	100 ohms	±10% "
7	H-8431-101	" "	" "	" "
8	H-8431-823	" "	82 K	±10% "
9	H-8431-471	" "	470 ohms	±10% "
10	H-8431-680	" "	68 "	" "
11	H-8450-510	" "	51 "	± 5% "
12	H-8450-511	" "	510 "	" "
20	H-8431-333	Fixed Comp.	33 K	±10% 1/4W
21	H-8431-222	" "	2.2 K	" "
22	H-8431-562	" "	5.6 K	" "
23	H-8431-331	" "	330 ohms	" "
24	H-8431-102	" "	1 K	" "
25	H-8431-101	" "	100 ohms	" "
26	H-8431-333	" "	33 K	" "
27	H-8431-562	" "	5.6 K	" "
28	H-8431-222	" "	2.2 K	" "
29	H-8431-331	" "	330 ohms	" "

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description			
R30	H-8431-333	Fixed Comp.	33 K	±10%	1/4W
31	H-8431-562	" "	5.6 K	"	"
32	H-8431-101	" "	100 ohms	"	"
33	H-8431-222	" "	2.2 K	"	"
34	H-8431-333	" "	33 K	"	"
35	H-8431-331	" "	330 ohms	"	"
36	H-8431-562	" "	5.6 K	"	"
37	H-8431-222	" "	2.2 K	"	"
38	H-8431-331	" "	330 ohms	"	"
39	H-8431-101	" "	100 "	"	"
40	H-8431-333	" "	33 K	"	"
41	H-8450-622	" "	6.2 K	± 5%	"
42	H-8431-122	" "	1.2 K	±10%	"
43	H-8431-151	" "	150 ohms	"	"
44	H-8431-102	" "	1 K	"	"
45	H-8431-333	" "	33 K	"	"
46	H-8450-622	" "	6.2 K	± 5%	"
47	H-8431-122	" "	1.2 K	±10%	"
48	H-8431-101	" "	100 ohms	"	"
49	H-8431-101	" "	" "	"	"
50	H-8431-682	" "	6.8 K	"	"
51	H-8431-332	" "	3.3 K	"	"
52	H-8431-222	" "	2.2 K	"	"
53	H-8431-223	" "	22 K	"	"

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description			
R54	H-8431-330	Fixed Comp.	33 ohms	±10%	1/4W
55	H-8431-681	" "	680 "	"	"
56	H-8431-153	" "	15 K	"	"
60	H-8431-681	Fixed Comp.	680 ohms	±10%	1/4W
61	H-8431-223	" "	22 K	"	"
62	H-8431-153	" "	15 K	"	"
63	H-8431-222	" "	2.2 K	"	"
64	H-8431-151	" "	150 ohms	"	"
65	H-8431-102	" "	1 K	"	"
66	H-8431-473	" "	47 K	"	"
67	H-8431-273	" "	27 K	"	"
68	H-8431-473	" "	47 K	"	"
69	H-8431-101	" "	100 ohms	"	"
70	H-8431-102	" "	1 K	"	"
71	H-8431-183	" "	18 K	"	"
72	H-8431-102	" "	1 K	"	"
73	H-8061-101	Variable Comp	100 ohms	±20%	3/8W
74	H-8431-561	Fixed Comp.	560 "	±10%	1/4W
75	H-8431-151	" "	150 "	"	"
80	H-6686-18	Fixed Comp.	900 ohms	± 1%	1/2W
81	H-6686-17	" "	666 "	"	"
82	H-6686-15	" "	111 "	"	"
83	H-6686-16	" "	500 "	"	"

Model 920 Standard Deviation Meter

Symbol	Meas. Part No.	Description			
R84	H-8450-303	Fixed Comp.	30 K	± 5%	1/4W
85	H-8497-103	Variable"	10 K	±20%	1/2W
86	H-8497-102	" "	1 K	"	"
90	H-8061-502	Variable Comp.	5 K	±20%	3/8W
91	H-8431-333	Fixed "	33 K	±10%	1/4W
92	H-8431-681	" "	680 ohms	"	"
93	H-8450-752	" "	7.5 K	± 5%	"
94	H-8431-820	" "	82 ohms	±10%	"
95	H-8431-333	" "	33 K	"	"
96	H-8061-251	Variable "	250 ohms	±20%	3/8W
97	H-8450-752	Fixed "	7.5 K	± 5%	1/4W
98	H-8450-431	" "	430 ohms	"	"
99	H-8431-680	" "	68 "	±10%	1/4W
100	H-8061-253	Variable "	25 K	±20%	3/8W
101	H-8450-431	Fixed "	470 ohms	±10%	1/4W
102	H-8431-223	" "	22 K	"	"
103	H-8431-682	" "	6.8 K	"	"
104	H-8431-820	" "	82 ohms	"	"
105	H-8431-681	" "	680 "	"	"
106	H-8431-680	" "	68 "	"	"
107	H-8431-391	" "	390 "	"	"
108	H-8431-103	" "	10 K	"	"
109	H-8450-753	" "	75 K	"	"

Model 920 Standard Deviation Meter

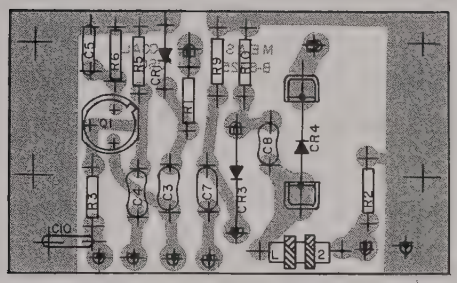
Symbol	Meas.. Part No.	Description		
R110	H-8431-103	Fixed Comp. 100 K	±10%	1/4W
111	H-8431-122	" " 1.2 K	"	"
112	H-8431-100	" " 10 ohms	"	"
120	H-3734-150	Fixed Comp. 15 ohms	±10%	2W
121	H-3730-390	" " 39 "	"	1W
130	H-6692B2803F	Fixed Comp. 280 K	± 1%	1/2W
131	H-8431-181	" " 180 ohms	±10%	1/4W
132	H-8450-911	" " 910 "	± 5%	"
133	H-8431-101	" " 100 "	±10%	"
134	H-8450-301	" " 300 "	± 5%	"
135	H-8431-101	" " 100 "	±10%	"
136	H-8495-102	Variable Comp. 1 K	±20%	3/8W
137	H-8495-103	" " 10 K	"	"
138	H-8431-123	Fixed Comp. 12 K	±10%	1/4W
139	H-8450-113	" " 9.1 K	± 5%	"
140	H-8431-561	" " 560 ohms	±10%	"
141	H-8450-510	" " 51 "	± 5%	"
142	H-8431-331	" " 330 "	±10%	"
143	H-8431-153	" " 15 K	"	"
144	H-8450-432	" " 4.3 K	± 5%	"
145	H-8450-333	" " 33 K	"	"
146	H-8431-561	" " 560 ohms	±10%	"
147	H-8450-164	" " 160 K	± 5%	"

Model 920 Standard Deviation Meter

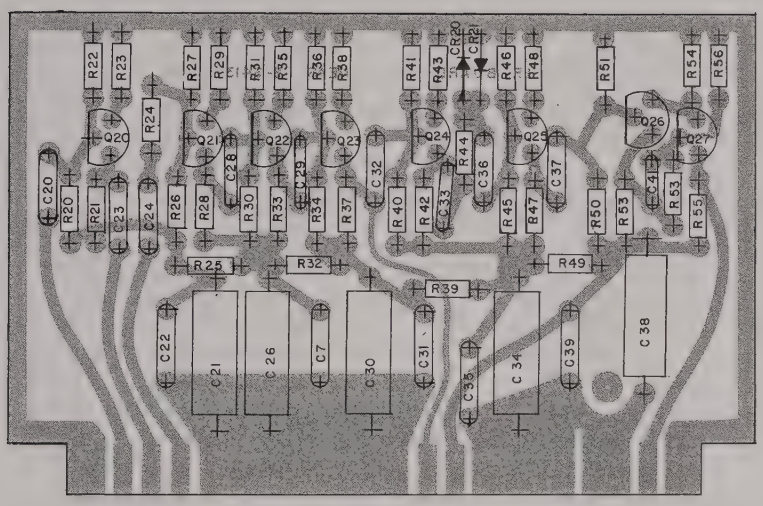
Symbol	Meas. Part No.	Description
IC90		MC-1306P Audio Output Stage

Miscellaneous

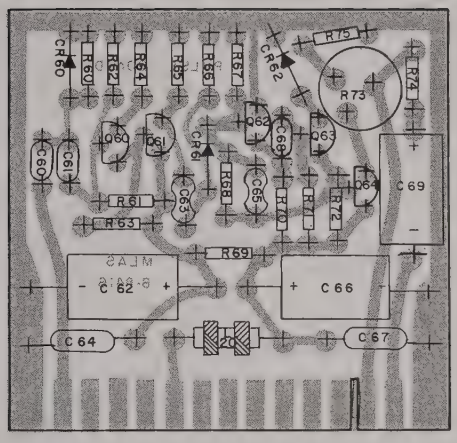
H-8086-6	Vernier Drive Knob
H-8086-7	Fine Tuning Knob
H-8086-7	Audio Level Knob
H-8086-7	R.F. Gain Knob
H-8086-1	Meter Range Knob
H-8096	Front Cover Assy. W/Speaker
H-8411	I.F. P.C. Bd., Assy.
H-8414	Pulse Network P.C. Bd., Assy.
H-8417	Audio P.C. Bd., Assy.
H-8420	Filter P.C. Bd., Assy.
H-8423	Local Osc., P.C. Bd., Assy.
H-8510	Speaker 8 ohms .2W
H-8463	Antenna



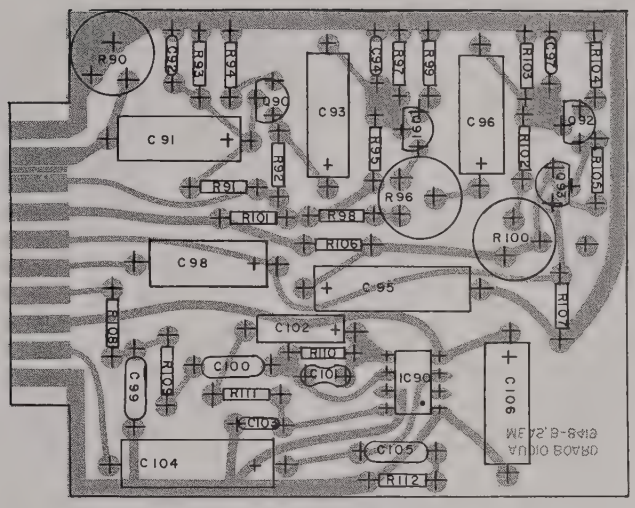
LOCAL OSC.
PR. CIR. BOARD



I. F.
PR. CIR. BOARD

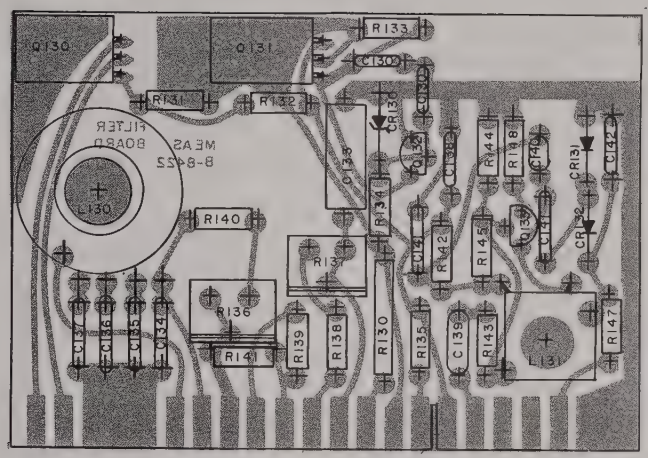


PULSE NETWORK
PR. CIR. BOARD

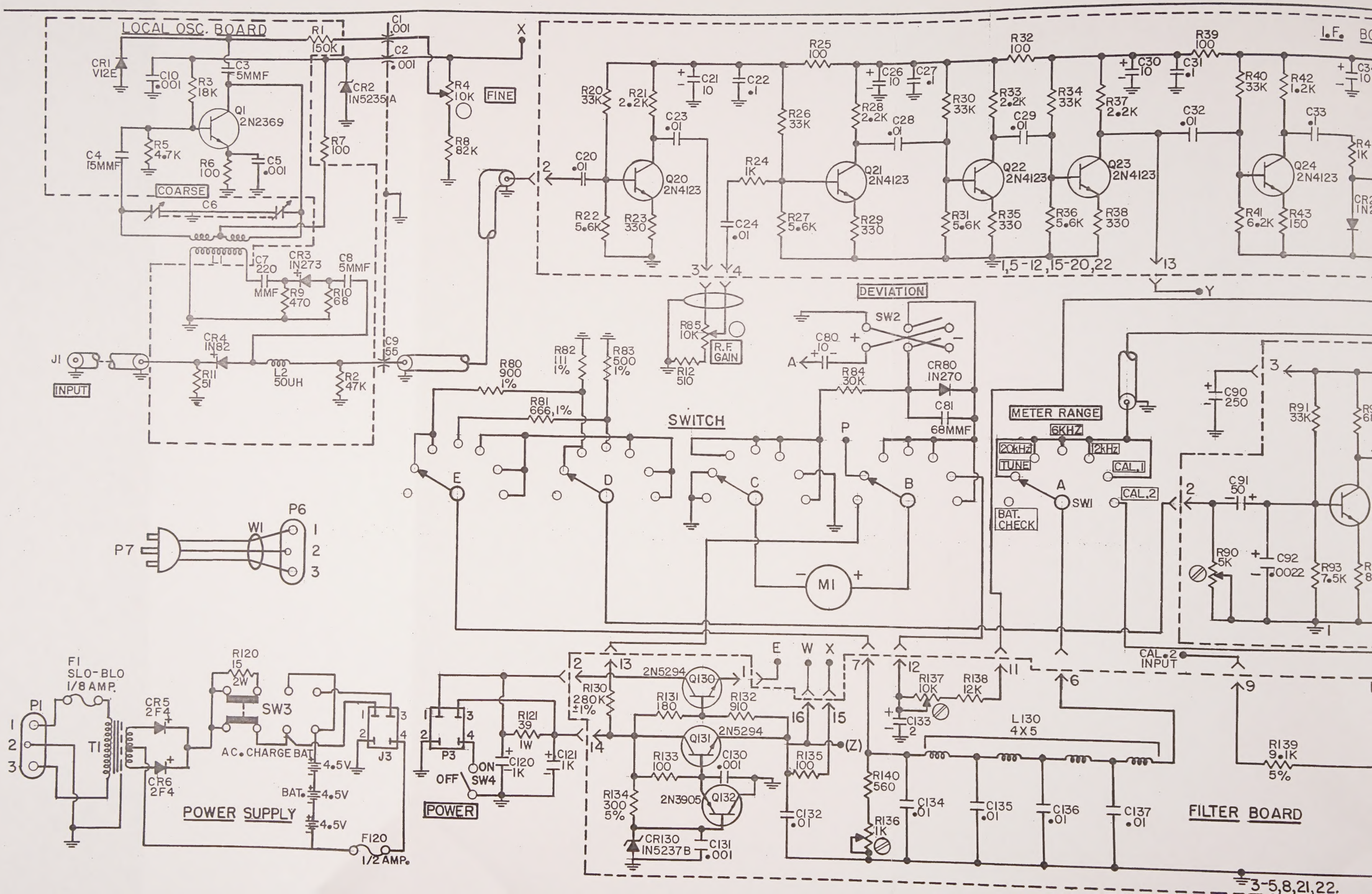


AUDIO

PR. CIR. BOARD



FILTER
PR. CIR. BOARD


LOCAL OSC. BOARD
R1 150K
C1 .001
C2 .001
X
CR1 VI2E
C10 .001
C3 5MMF
R3 18K
Q1 2N2369
CR2 IN5235A
R4 10K
FINE
R8 82K
R7 100
C4 15MMF
R5 4.7K
R6 100
C5 .001
COARSE
C6
L1
C7 220 MMF
CR3 IN273
C8 5MMF
R9 470
R10 68
J1
INPUT
CR4 IN82
R11 51
L2 50UH
R2 47K
C9 55
I.F. BO
R20 33K
R21 2.2K
C21 10
C22 .1
R25 100
C26 10
C27 .1
R32 100
C30 10
R39 100
C31 .1
R40 33K
R42 1.2K
C23 .01
C20 .01
Q20 2N4123
R22 5.6K
R23 330
R24 1K
C24 .01
R26 33K
Q21 2N4123
R27 5.6K
R28 2.2K
C28 .01
R29 330
R30 33K
R33 2.2K
C29 .01
Q22 2N4123
R31 5.6K
R35 330
R34 33K
R36 5.6K
Q23 2N4123
R37 2.2K
C32 .01
R38 330
C33 .1
Q24 2N4123
R41 6.2K
R43 150
1,5-12,15-20,22
13
Y
Y
R85 10K
R.F. GAIN
R12 510
DEVIATION
SW2
C80 10
A
R84 30K
CR80 IN270
C81 68MMF
R80 900 1%
R82 111 1%
R83 500 1%
R81 666.1%
SWITCH
E
D
C
P
B
METER RANGE
6KHZ
20KHz
12kHz
TUNE
CAL.1
CAL.2
BAT. CHECK
A
SW1
M1
C90 250
R91 33K
C91 50
R90 5K
C92 .0022
R93 7.5K
CAL.2 INPUT
P6
P7
W1
1
2
3
F1 SLO-BLO 1/8 AMP.
P1
TI
CR5 2F4
CR6 2F4
R120 15 2W
SW3
AC. CHARGE BAT.
4.5V
BAT. 4.5V
4.5V
J3
POWER SUPPLY
F120 1/2 AMP.
P3
ON
OFF
SW4
POWER
R121 39 1W
C120 1K
C121 1K
2N5294
Q130
R130 280K ±1%
R131 180
R132 910
Q131
2N5294
R133 100
C130 .001
R135 100
2N3905
Q132
R134 300 5%
C132 .01
CR130 IN5237B
C131 .001
E
W
X
(Z)
R137 10K
R138 12K
C133 2
L130 4X5
R139 9.1K 5%
R140 560
R136 1K
C134 .01
C135 .01
C136 .01
C137 .01
FILTER BOARD
3-5,8,21,22.

PULSE NETWORK BOARD

AUDIO BOARD

R49 100
C35
R45 33K
R47 1.2K
C38 10
C39
R50 6.8K
R52 2.2K
C41 68MMF
R55 680
C37
C36
Q25 2N4123
Q26 2N4123
Q27 2N4123
R53 22K
CR21 IN273
R46 6.2K
R48 100
R51 3.3K
R54 33
R56 15K
14
21
W

C60 220 MMF
CR60 IN273
C61 220 MMF
R60 680
R61 22K
R63 2.2K
Q60 2N4123
Q61 2N4123
R62 15K
R64 150
C62 50
C63 47MMF
CR61 IN914
R65 1K
R66 47K
R67 27K
R69 100
C64 .22
C65 10MMF
R68 47K
C66 50
C67 .22
Q62 2N4123
R70 1K
C68 150 MMF
R71 18K
R72 1K
Q63 2N4123
Q64 2N4123
CR62 IN270
R73 100
R75 150
L20 50UH
R74 560
C69 50
2
6
13
14
1,15
W

R101 470
C95 100
R100 25K
R102 22K
R105 680
R106 68
R95 33K
R98 430
R96 250
C96 50
Q91 2N4123
Q92 2N4123
Q93 2N4123
C97 .0022
C94 .0022
R97 7.5K
R99 68
R103 6.8K
R104 82
R107 390
C98 25MF
R86 1K
AUDIO LEVEL
R108 10K
R109 75K
C99 0.1
C100 0.1
C101 15MMF
R110 100K
C102 2MF
R111 1.2K
C103 470 MMF
IC90 MC1306P
C104 100
C105 0.1
R112 10
C106 25
J5
SPKR.
P5
SPEAKER 8OHMS 0.2W
4
5
6
7
8
9
10
W
E

Y
17
(Z)
R142 330
C138 .01
R145 33K 5%
L131 8MH
C140 270MMF
R147 160K
C139 .1
R143 15K
Q133 2N4123
C141 .01
CR132 IN270
CR131 IN270
C142 .01
R144 4.3K 5%
R146 560
R141 51 5%
P
20
A
J4
SCOPE
5

D-8512

NOTES:

⊘ = SCREWDRIVER ADJ.

○ = FRONT PANEL CONTROL

XXX = FRONT PANEL MARKING

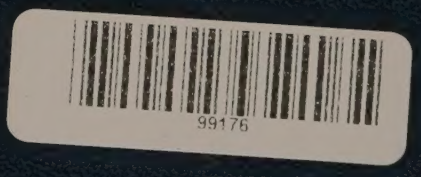
= INTERCONNECTING SHIELDED CABLE CONNECTIONS

UNLESS OTHERWISE SPECIFED

ALL FIXED RESISTANCES IN OHMS, 1/4W, 10%

ALL CAPACITANCES IN MF.

ALL INDUCTANCES IN MICROHENRIES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